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WSTIAC

WEAPON SYSTEMS TECHNOLOGY INFORMATION ANALYSIS CENTER

Contents

WSTIAC is a DoD Information Analysis Center Sponsored by the Defense Technical Information Center

Alternatives to the Future Combat System Program

by Mr. Andrus Viilu

Introduction

The Congressional Budget Office (CBO) has been asked by the Air Land Subcommittee of the House Armed Services Committee to review the affordability of the Army's Future Combat System (FCS) program. The FCS program will begin to modernize Army brigades in 2014, and there are concerns with the costs of the program in light of the Army's other funding needs. The CBO has proposed four alternatives to the FCS program in its report (*The Army's Future Combat System Program and Alternatives*, August 2006) that ease the budget pressures by eliminating major components of the FCS program. The implications of deaggregating the FCS "how-to-fight" concept will be discussed below in terms of the FCS Operational and Organizational Plan (TRADOC Pamphlet 525-3-90, 25 November 2002) and the initial results of the combat effectiveness analyses that were completed by the Army as part of the Milestone B review process. Alternative approaches for modernizing Army brigades preserve the Army goal of an exponential increase in Army lethality and survivability, while maintaining greater compatibility between the Army's combat ready brigades that are being partially modernized as they cycle back into Iraq and the FCS brigade of the future. Clearly, the circumstances have changed since General Shinseki first announced the FCS program in October 1999, and Congress is less willing to wait for the Block 1 fielding of the FCS program in 2014 while the country is at war.

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Published in Fall 2006 features an article "Alternatives to the Future Combat System Program". Also contains "Director's Corner, "In the News", "WSTIAC Courses" and "Calendar of Events".Contents of in the News: DARPA Performs Worlds First Hands-Off Autonomous Air Refueling Engagement, Keel Laid for Revolutionary Dual-Use Catamaran Vessel, M/V Susitna, and Missile Defense Exercise and Flight Test Successfully Completed

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Director's Corner

by Mr. Gary J. Gray

Ladies and Gentlemen:

Welcome back to the fall edition of our newsletter. In this edition, we have another article by Mr. Andrus Viilu. He discusses the Army's flagship program—The Future Combat Systems (FCS).

The article addresses the Congressional Budget Office (CBO) study of the future of the FCS program. The CBO proposes four alternatives to the current program. Mr. Viilu analyzes these alternatives and proposes a slightly different approach to increase total force effectiveness as FCS is fielded.

If you have an interest in the future of the FCS and the Army, this article is for you.

I welcome your feedback and look forward to any comments you may have.

Sincerely,

Gary J. Gray

The WSTIAC Newsletter is the current awareness publication of the Weapon Systems Technology Information Analysis Center (WSTIAC). WSTIAC, a Department of Defense (DoD) Information Analysis Center (IAC), is administratively managed by the Defense Technical Information Center (DTIC) under the DoD IAC Program.

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Alternatives... *(Cont from page 1)*

CBO Proposed FCS Alternatives

The four alternatives to the FCS program that have been proposed by the CBO attempt to address the major concerns related to the program including technical feasibility, cost, and slow rate of introduction of the systems into the Army force structure. Under Alternative 1, the Army would develop and purchase the full suite of sensors to provide enhanced information dissemination capabilities and a version of the FCS network to share the information. All manned vehicles, all unmanned ground vehicles, the non-line-of-sight launch system, and the intelligent munitions systems would be cancelled. Some of the savings from the cancelled FCS components would be used to accelerate the modernization rate of Army brigades, as compared to the 1.5 brigades per year envisioned for FCS. The bulk of the savings would be used to refurbish Army tracked vehicles to keep the fleet from aging.

Alternative 2 emphasizes long-range strikes. It funds a scaled-down computer network for sharing data, the Class III and IV unmanned aerial vehicles (UAVs), unattended ground sensors, and the non-line-of-sight launch system. It cancels all manned vehicles, Class I and II UAVs, all unmanned ground vehicles, and the intelligent munitions systems. Again, legacy tracked vehicles would be upgraded and the brigade modernization rate enhanced.

Alternative 3 is designated as the new vehicle technology alternative. It includes a scaled-down version of the computer network and five new manned vehicles (including an infantry carrier, a self-propelled mortar, a self-propelled howitzer, a command and control vehicle and a medical vehicle). It would cancel the mounted combat system, the recovery and maintenance vehicle, the reconnaissance and surveillance vehicle, unmanned ground vehicles, all UAVs, the non-line-of-sight launch system, unattended ground sensors, and the intelligent munitions system. Again, upgrades to existing Army tracked vehicles are funded but at a slightly lower level to reflect the acquisition of new combat systems.

Alternative 4 is the least costly alternative. It would upgrade existing Army tracked vehicles and would build the FCS network. Compared to the estimated total acquisition cost of $162 billion for 15 FCS brigades, Alternatives 1, 2, and 3 are estimated to cost about $100 billion, while Alternative 4 would cost about $70 billion.

FCS Operational Concept

The Army's intent is to maintain military supremacy in the future with a more strategically responsive, deployable, agile, versatile, lethal, survivable and sustainable force. Although the deployability of FCS units is considered to be important, the capability to conduct decisive operations is considered to be the highest priority. The FCS unit of action or brigade builds lethal overmatch through combining maneuver, firepower, protection and leadership with situational understanding derived from real-time, accurate information. The organic Brigade Intelligence and Communications Company, along with manned and unmanned ground and aerial vehicles, and reconnaissance and surveillance units is the basis for the integrated communications, analysis and reconnaissance capabilities that are designed to enhance brigade combat power exponentially.

The Combined Arms Battalion provides the maneuver capability of an FCS brigade. It includes 25 infantry carriers, 18 mounted combat systems, 20 command and control vehicles, eight self-propelled mortars, nine reconnaissance and surveillance vehicles, and 21 armed robotic vehicles, as its major components of combat power. It also includes Class I and II UAVs, launch and control capabilities for Class III UAVs, and over 50 smaller unmanned ground vehicles (Multifunctional Utility/Logistics and Equipment robotic vehicle (MULE) and Small Unmanned Ground Vehicles (SUGV)). The Combined Arms Battalion is designed to close with and destroy the enemy.

The Non-Line-of-Sight (NLOS) Battalion provides destructive, protective and special purpose fires to enable FCS brigades to conduct decisive operations. It includes 18 NLOS cannons and 60 NLOS missile launch systems, three Class III UAV control units and six Class I UAVs.

The four classes of UAVs that are integrated into all echelons of the FCS brigade provide enhanced situation awareness and thus enable situation understanding. They also provide a communications relay, and sensor information for the common operating picture (COP). The

Multifunctional Utility/Logistics and Equipment Robotic Vehicle (Photo courtesy of US Army)

Alternatives... *(Cont from page 3)*

Class I UAV is organic to infantry and recon platoons, and provides perimeter security to NLOS Battalions and Forward Support Battalion companies. The Class I UAV is small (man-portable) and allows the soldiers to see over the "next hill". The Class II UAV is organic to infantry and mounted combat system (MCS) companies. The vehicle is light enough to require no more than two soldiers to remount a launch vehicle onto an FCS ground vehicle. It performs target acquisition and designation, and route security for infantry and MCS companies. The Class III UAV is organic to NLOS Battalions and reconnaissance detachments. It has its own dedicated launch platform and provides reconnaissance, surveillance and target acquisition functions, with emphasis on targeting. It has the capability for mine detection, meteorological survey, and chemical/biological/nuclear explosives detection. The Class IV UAV is organic to the Aviation Detachment at the brigade level. It is capable of teaming with reconnaissance helicopters to extend manned vehicle reconnaissance operations. The Class IV UAV is capable of persistent staring, long endurance communication relay capabilities and emitter location mapping.

The Unmanned Ground Vehicle (UGV) component of the FCS brigade is designed to perform routine and dangerous missions. The Armed Robotic Vehicle has three payloads (Assault, Assault Light and RSTA), and can self-deploy along with manned FCS vehicles. It will provide remote reconnaissance capability, operate direct fire weapons, deploy special weapons, and provide a communications relay capability. The MULE provides transport of equipment and supplies to dismounted maneuver elements. The SUGV will assist in shaping the battle space and will provide force protection, especially in built-up areas.

The FCS brigade is designed to fight an adaptive enemy with inherent air-ground integration and manned, unmanned teaming with organic unmanned systems.

FCS Combat Effectiveness

As a major component of the FCS Milestone B review process, the Army compared the combat effectiveness of FCS brigades to the legacy force in a number of battlefield scenarios. The Caspian Sea scenario with a number of battle vignettes, the Balkans scenario, and a Baku urban assault vignette were analyzed for the 2010 timeframe against Block 1 FCS forces. At the brigade tactical engagement level, the Janus and Combined Arms and Support Task Force Evaluation Model (CASTFOREM) simulation models were used. The Joint Conflict and Tactical Simulation (JCATS) was used to evaluate the combat effectiveness of alternative forces in the urban environment.

Class 1 UAV (Photo by Steve Harding, courtesy of US Army)

Depending on the scenario, FCS forces killed from 1.5 to 4 times as many threat forces with NLOS fires compared to heavy legacy forces. The enemy forces that remain to be killed with direct fire systems during the assault phase ranged from 20 to 50% of the force that faced the legacy force. Killing threat indirect fire systems early resulted in the FCS brigade losing fewer infantry and manned vehicles to threat indirect fire systems. Unmanned ground robotics mitigated the risk to infantry and manned vehicles. For the Balkan scenario, total friendly infantry losses dropped from 80 to about 20, vehicles from 27 to fewer than five. For the Caspian Sea vignette, the total friendly infantry losses dropped from 25 to about four, and vehicle losses from twelve to about two (Tactical-Level Force Effectiveness Analysis, US Army TRADOC Analysis Center, April 2003).

For the urban combat analysis using JCATS, the base force did not succeed in accomplishing the mission while the Block I FCS force was clearing the objective area at the end of the exercise. The base force had 33% of the infantry surviving at the end of the exercise and 40% of the vehicles, compared to 69% of the force surviving for the Block I FCS force and 63% of the vehicles. Only 51% of the unmanned ground vehicles in the FCS force survived. The Loitering Attack Munition (LAM) claimed a large fraction of enemy armored vehicle kills for the Block I FCS force (FCS AoA, Mout Exercise, April 2003—TRAC-WSMR).

Military Worth of CBO Alternatives

There are a number of criteria for evaluating alternative acquisition programs. Among these criteria are 1) technological maturity of program components, 2) military

worth of the proposed capability, and 3) program affordability. Since FCS brigades are designed for decisive tactical operations, components of offensive operations, such as non-line-of-sight fires in preparation for the attack, maneuver of close combat forces to position of tactical advantage, the assault phase, and the rapid transition to the next engagement, were examined in the previous section. There is insufficient validity in these combat simulation tools to cite numerical results, and the CBO alternatives have not been specifically evaluated by the Army. The broad combat effectiveness trends demonstrated by the analysis, however, offer useful guidance.

CBO Alternative 1 retains FCS target acquisition, and surveillance and reconnaissance capabilities without any means to employ the targeting data. The lethality of NLOS fires is not available. There should be sufficient information and connectivity for good situation understanding that would permit maneuver without the need for contact with the enemy to define the situation. Without the attrition of enemy forces with NLOS fires or the rapid ability to defeat enemy indirect fire systems, and in the absence of the Armed Robotic Vehicle, the assault phase would result in severe casualties to friendly forces and would prevent rapid transition of the brigade to the next battle.

CBO Alternative 2 fields the long-range strike capabilities of FCS forces along with the necessary targeting systems. This permits a favorable initial phase of brigade operations, but the lack of Class I and II UAVs raises concerns about the route security for the maneuver phase, and the absence of armed robotic vehicles will result in additional losses during the assault. Again, there is a concern that accumulated losses during the attack will delay transition to the next battle. As a separate component of force modernization, CBO Alternative 2 would likely be evaluated as being cost-effective.

CBO Alternative 3 replaces M113 derivative vehicles and M109 howitzers in the Army's heavy force. Since the mounted combat system, recovery vehicle, and reconnaissance and surveillance vehicles are canceled, then presumably, the M1 tank, M88 Recovery Vehicle and the M3 Cavalry Vehicle would be retained in the force despite their significant negative impact on force sustainability. In the absence of all UAVs, long-range strike capabilities, and unmanned vehicles during the assault, this alternative would perform no better than the legacy heavy force and, at an acquisition cost of about $100 billion, would not be cost effective.

CBO Alternative 4 appears to be very similar to the capabilities deployed some years ago in the 4th Infantry Division (Mech) with the Force Battle Command Brigade and Below (FBCB2) system. There have been additional force upgrades as part of the brigade rotation in Iraq, including the Command Post of the Future, airborne communication relays, and additional satellite communication links. The shared situation awareness and the common operating picture would permit the brigade commander to make better decisions and communicate this to his subordinate units. It is no longer appropriate to judge the cost-effectiveness of these actions with combat models, since they are serving the units well in a combat environment.

The concern with combat losses and the ability of the brigade to transition to the next battle appear as important, but secondary, considerations for the brigade battle; however, they are critical considerations at the operational level of war. In the Caspian Sea scenario, the FCS Block 1 force reached their objective in seven days compared to 21 days for the legacy force. This is very similar to the combat experience during the initial phase of operations in Iraq, where both the Marine forces and the 3rd Infantry Division (Mech) reached Baghdad within weeks. The enemy forces could not keep up with the pace of battle imposed by US Forces.

It should also be noted that canceling FCS components because the technology readiness levels are too low foregoes these capabilities in the future. There is no longer a well-funded Army research and development program that will enhance technical readiness of new concepts. If the program is not linked to FCS or one of its complementary systems, it is not going to be funded in the Army budget. As reported in the CBO study, the complete network with its 36 million lines of code is the highest risk component of FCS. This is further underlined by the recent difficulties experienced by two complementary programs that are vital to FCS: the JTRS software radio and the WIN-T broadband communications network.

FCS Non-Line-Of-Site Mortar (Photo courtesy of US Army)

Alternatives... *(Cont from page 5)*

The Way Ahead for Fielding FCS Technologies

The CBO is justified in their concern with the slow pace of modernization of Army brigades. Clearly, if it takes until 2037 to modernize the 29 heavy brigades with FCS technologies, and until 2060 to modernize all 70 brigades, then the technologies we are investing in today will be obsolete before these brigades are fielded. While the Comanche helicopter is not a typical Army acquisition program, it was necessary to add an additional $500 million to the budget during the late 1990s in order to replace the once state-of-the-art electronics suite, because the industry no longer manufactured the 1980s components. During the end of the future-years-defense-plan, there should be a program for upgrading FCS electronic technologies, which should be revisited every three to five years as new technologies become available.

Also, as the CBO has documented, while deployability is important, the Department of Defense should not expect dramatic improvements in air deployability of FCS brigades. If a scenario requires more than four brigades, it is unrealistic to consider air deployment of the brigades. If the brigades are deployed on ships, then the weight of combat vehicles matters very little. The focus should be on roads and bridges in the area to which brigades are shipped, just as US forces experienced in the Balkans. The value of a weight-constrained family of vehicles is in the supportability of the force, for both fuel consumption and vehicle repair.

What should be retained is the FCS "how-to-fight" concept. The Army is charged by Congress to equip and train land combat forces. The training of leaders and troops to make the best use of the available equipment is usually more important than technical features of the equipment. The FCS organizational and operational concept can provide the basis for training future leaders. Many of the FCS combat tasks can be accomplished with Army brigades that are deployed in Iraq with some assistance from Air Force sensors, communication relays and weapons.

The Army has a program for spiraling FCS technologies into combat-ready brigades. The scope of this near-term modernization program needs to be broadened in terms of the number of brigades to be partially modernized and strengthened. The existing Army program will result in fifteen high technology FCS brigades that cannot interoperate with the rest of the Army force. This cannot be allowed to occur. The Department of Defense must assure that the rest of the force structure can interoperate with FCS brigades when they are fielded, even if it is at the cost of a slower introduction rate for FCS brigades.

Conclusion

In summary, rather than deaggregate the FCS "how-to-fight" concept, as the CBO proposes, the Army should deploy mature components of the computer network for situation understanding and targeting as rapidly as is affordable, and integrate the Air/Land team at the tactical level. These initial gradual steps should permit growth to the full FCS capabilities.

The CBO is justified in its concern with the proposed FCS modernization rate that is severely constrained by the acquisition cost of Block 1 FCS brigades. The communications, computational and sensing technologies are evolving too rapidly to be compatible with program end dates of 2025, 2037, or 2060. An affordable package of near-term capabilities and a minimum of three brigades per year should be the goal. The FCS brigades that deploy in 2014 should be readily integratable with these near-term enhanced brigades. ◆

ABOUT THE AUTHOR

Andrus Viilu is a WSTIAC Subject Matter Expert for land warfare and related technologies. He has recently retired from the Office of the Under Secretary of Defense (Acquisition, Technology and Logistics), where he served as Director of Land Warfare. In this capacity, he maintained management oversight of close combat, fire support, air defense, Army aviation, and combat support mission areas. He managed milestone decision reviews for major land warfare weapon systems, participated in program budget decisions and contributed to defense guidance and the military Services' five-year plans. In the past, he was Vice President at Aeronautical Research Associates of Princeton, a member of the research staff of the Systems Evaluation Division at the Institute for Defense Analyses, and Director of Tactical Weapons Technology at The System Planning Corporation. He holds a B.S. in Aeronautical Engineering from MIT and has performed Masters degree work in Applied Mathematics at the University of California.

Directed Energy Weapons Course

Instructor: Dr. Edward Scannell, WSTIAC

Location: Huntsville, Alabama
27-28 February 2007

Course Description:

This two-day classified short course provides an introduction to the basic principles and techniques of Directed Energy Weapons (DEWs). The technologies behind each type of DEW will be examined, and the critical path components will be identified and explored with respect to their effect on future DEW development. In addition, advantages that can be achieved by employing DEWs will be discussed, as well as the status of U.S. and foreign DE developments and deployments. The key DEW programs in High Energy Lasers and RF-DEWs or High Power Microwaves will be fully described.

This short course will be of great benefit to people who need to understand the basic concepts, technologies, design requirements and practical applications of DEWs, including program and business managers, political decision makers, engineers, scientific researchers and military personnel. An undergraduate technical degree is recommended. Mathematics is kept to a minimum, but important formulas are introduced.

Questions to be examined include:

- What is Directed Energy and what are the different types of Directed Energy Weapons?
- What are the advantages and disadvantages of each type of DEW and what are their target effects and tactical and strategic capabilities?
- How do DEWs work and what are the critical technologies that must be developed for their eventual use in practical systems?
- How may threat DEW effects be countered and how can we protect our own systems?
- What are the major U.S. and international DEW programs that are being pursued?
- What is the prognosis for future DEW development?

About the Instructor:

Dr. Edward Scannell is the Senior Program Manager of the Engineering & Technical Division, Chief Scientist for WSTIAC, and formerly Chief of the Directed Energy and Power Generation Division of the U.S. Army Research Laboratory. He has more than 30 years of experience in technical areas related to DEWs, including: plasma physics; conventional and alternative energy sources, electromagnetic (EM) guns, particle beam, laser, high power microwave (HPM), and pulse power physics.

Security Classification:

The security classification of this course is UNCLASSIFIED, but is designated export controlled and limited to U.S. citizens only.

Training at Your Location:

WSTIAC can conduct this course at your location to reduce your travel time and cost. Please call Mrs. Kelly Hopkins to discuss.

Fee:

The registration fee for this 2-day course is $950 for U.S. government personnel and $1150 for government contractors. Contractor teams of 3 or more, registered at the same time, are charged $950 per person.

Handout Material:

Each student will receive a comprehensive set of course notes covering the material presented.

For additional information, contact:
Mrs. Kelly Hopkins, Seminar Administrator,
at (256) 382-4747, or by e-mail
khopkins@alionscience.com

Notice: WSTIAC reserves the right to cancel and/or change the course schedule, agenda and/or instructor. In the event of a schedule change or cancellation, registered participants will be individually informed.

in the news...

DARPA Performs World's First Hands-Off Autonomous Air Refueling Engagement

The Defense Advanced Research Projects Agency (DARPA), in a joint effort with NASA Dryden Flight Research Center, performed the first-ever autonomous probe-and-drogue airborne refueling operation August 30, at Edwards Air Force Base, California. The demonstration was conducted with a NASA F/A-18 configured to operate as an unmanned test bed.

The Autonomous Airborne Refueling Demonstration (AARD) system used GPS-based relative navigation, coupled with an optical tracker, to provide the precise positioning required to put a refueling probe into the center of a 32-inch basket dangling in the air stream behind an airborne tanker. The tanker was equipped with a small relative navigation pallet, but production refueling equipment was not modified in any way. Pilots were on board the F/A-18 for safety purposes.

Autonomous in-flight refueling is a critical enabler for affordable, persistent, unmanned strike systems. "This flight is a significant milestone – it demonstrates that autonomous systems can employ the benefits of air-refueling that have proven so valuable to military aviation," said Lt. Col. Jim McCormick, DARPA program manager.

"We chose to demonstrate the probe and drogue refueling method because it is the most challenging for autonomous systems. The precise station-keeping capability we've demonstrated applies equally to the boom and receptacle method used by most Air Force aircraft," noted McCormick. The same technology also promises to enhance reliability, safety and the range of operating conditions for air refueling manned aircraft.

The flight was the seventh of eight planned for the 15-month AARD proof of concept program. For this particular test, the pilot provided approval to proceed at several stages of the maneuver, but was otherwise hands-off. Operationally, unmanned systems are expected to locate the tanker, form up, accept clearances, refuel, and disengage without any human intervention.

System performance fully met expectations for the flight. "The end-game movement of the autonomous system had none of the last-second, high-gain stabs at the basket that we often see with human pilots. This computer approach was unbelievably stable and smooth, with deliberate movements throughout. And when it missed, it was just as smooth when backing up to a restart point," said NASA test pilot Dick Ewers.

The AARD system was operating in benign flight conditions when it successfully engaged the basket in two out of six attempts. As important as the successful engagements, the system safely recovered from each missed attempt. Miss tolerances were tight for this first attempt. During one of the missed attempts, the pilot observed the probe was actually inside the basket when the system pulled back. More robust tracking algorithms and relaxed miss tolerances are planned to be demonstrated on a final flight later this month.

DARPA initiated AARD under the former Joint Unmanned Combat Air Systems program. The AARD system was developed by Sierra Nevada Corp., with team member OCTEC Ltd. providing the optical tracking system. Omega Air Refueling Services operated the modified 707-300 tanker used for the tests.

Successful demonstration of the AARD capability will allow unmanned air system developers and planners to leverage, with confidence, the operational advantages of in-flight refueling.

DARPA Press Release

Contact: Jan Walker 703-696-2404, jan.walker[at]darpa.mil, or Lt. Col. Jim McCormick, USAF 571-218-4404

Keel Laid for Revolutionary Dual-Use Catamaran Vessel, M/V Susitna

On August 24, 2006, onlookers gathered at the shipyard of Alaska Ship & Drydock Inc. in Ketchikan, Alaska, to witness the keel laying of what will be a very unusual and versatile ship.

Senator Lisa Murkowski (R-AK), the vessel's sponsor, performed the honors as she welded her name onto the keel of the M/V *Susitna*, a twin-hulled catamaran ferry that is being funded jointly by the Office of Naval Research (ONR) and Alaska´s Matunuska Susitna (Mat/Su) Borough. Attendees also included ONR's Chief of Naval Research RAdm. William E. Landay, Mat/Su Borough Mayor Tim Anderson, as well as State of Alaska and Ketchikan officials and the management team for the *Susitna* program.

When complete, the *Susitna* (which is named after a river and mountain in south central Alaska, and means "sleeping lady") will be operated by the Mat/Su Borough as a ferry between Anchorage and Port Mackenzie. ONR also is interested in the vessel's transformational hull form as a technology demonstrator to support the Navy's sea basing and expeditionary warfare concepts.

The ship will have a center "barge" that can be hydraulically raised and lowered; it also will have the option to adjust the buoyancy of its catamaran hulls while under way. The vessel will demonstrate the functionality of a ship that can provide a multi-purpose, expeditionary cargo and troop ship that performs efficiently at high speed, in ice, and in shallow waters, and that can even beach itself to load/discharge vehicles up to tank size.

The vessel will have three distinct modes of operation: a catamaran mode for high speeds; a small-water-area-twin-hull (SWATH) mode for stability in high sea states; and a shallow-draft landing-craft mode that provides substantial buoyancy for maneuvering in shallow water. In addition, the *Susitna* will be the world´s first ice-breaking twin-hulled vessel.

Vessel Characteristics:

- Length: 195 Feet, Beam – 60 feet
- Displacement: 940 tons, full load

- Variable Draft - SWATH mode is 12± feet, shallow-draft landing-craft mode is 4± feet
- Capacity: 100 Passengers and 20 vehicles
- Speed: 20 knots
- Power Plant: 4 ea., MTU 12V 4000 diesel engines

The Susitna project is a collaboration between the Office of Naval Research, the Matanuska-Susitna Borough, and Alaska Ship & Drydock. It is funded through the Office of Naval Research's Sea Warfare and Weapons Department, Code 33X (Paul Rispin, program manager).

Contact: Colin Babb, Office of Naval Research, 703-696-4036, Colin_Babb@onr.navy.mil

Missile Defense Exercise and Flight Test Successfully Completed

Members of the 100th Missile Defense Brigade (Ground-based Midcourse Defense) and 49th Missile Defense Battalion (GMD) took part in a test of the GMD system beginning Sept. 1 at 1:22 p.m. Eastern when a long-range ballistic missile target lifted off from the Kodiak Launch Complex in Alaska. Seventeen minutes later, military operators launched an interceptor from Vandenberg Air Force Base, Calif. After flying into space, the interceptor released its exo-atmospheric kill vehicle, which proceeded to track the target warhead. Due to earlier program accomplishments, several test objectives were accelerated and included in this test, according to a Boeing press release.

The test achieved several significant objectives for the first time:

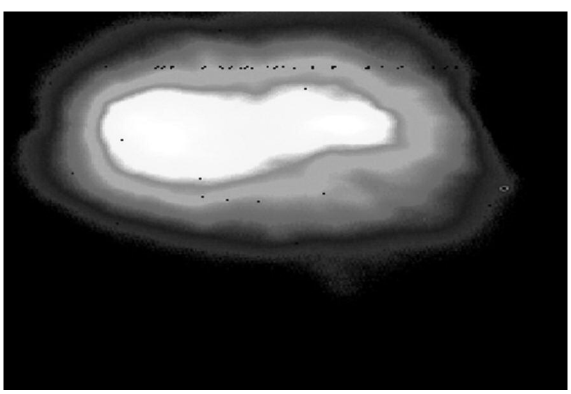
- An operationally configured interceptor was fired from an operational GMD site;
- An operationally configured interceptor tracked a ballistic missile;
- A newly upgraded missile-warning radar at Beale Air Force Base, California, provided target data to an in-flight interceptor;
- The mission-control center at the Joint National Integration Center in Colorado Springs controlled a live GMD engagement.

Although not a primary objective of the test, the kill vehicle intercepted the warhead and destroyed it. This was the first intercept with an operationally configured interceptor, according to a Boeing press release.

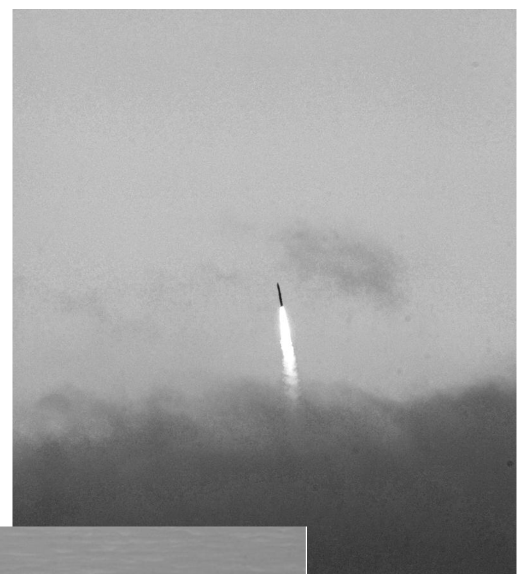
"Today's successful test is a major accomplishment for the GMD team and demonstrates a significant step in GMD's evolution to a robust and reliable capability for the warfighter," said Pat Shanahan, vice president and general manager of Boeing Missile Defense Systems.

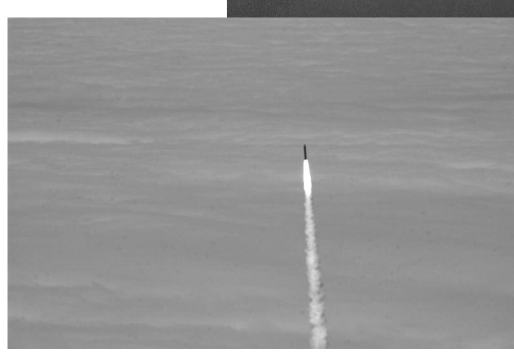
The "warfighters" mentioned by Shanahan are members of the 100th Missile Defense Brigade based in Colorado Springs and the 49th Missile Defense Battalion out of Fort Greely, Alaska.

U.S. Army Space & Missile Defense Command/U.S. Army Forces Strategic Command Press Release. ◆



GMD Flight Test Ground-based Interceptor (FTG)-02 — Flight Test Ground-based Interceptor (FTG)-02 took place Sept. 1, 2006. The operationally configured interceptor intercepted the target and destroyed it on impact as shown in this sensor screen. (Photo courtesy of Boeing)





GMD Flight Test Ground-based Interceptor (FTG)-02 — Flight Test Ground-based Interceptor (FTG)-02 took place Sept. 1, 2006. The operationally configured interceptor was launched from Vandenberg Air Force Base, Calif. The launch was part of the flight test program for the Ground-based Midcourse Defense program. (Photos courtesy of Boeing)

Introduction to Sensors and Seekers for Smart Munitions and Weapons Course

Instructor: Mr. Paul Kisatsky, WSTIAC

Location: Huntsville, Alabama
13-15 February 2007

Course Description:

This 3-day short course provides an introduction to the most commonly used sensors and seekers employed in smart munitions and weapons (projectiles, missiles and wide area mines). It is oriented to managers, engineers, and scientists who are engaged in smart weapons program development and who desire to obtain a deeper understanding of the sensors they must deal with, but who do not need to personally design or analyze them in depth. An undergraduate technical degree is recommended. Mathematics is kept to a minimum, but important formulas are introduced. This course also provides an excellent foundation for those scientists and engineers who desire to pursue this discipline to intermediate and advanced levels.

The course covers:

- Classification of seekers and sensors
- Fundamentals of waves and propagation
- Fundamentals of noise and clutter
- Fundamentals of search footprints
- Introduction to infrared
- Introduction to radar
- Introduction to ladar
- Introduction to visionics
- Introduction to acoustics
- Future projections and interactive brainstorming

Noise and clutter, the predominant obstacles to success in autonomous seekers, are given emphasis. The major sensor types are classified and each is discussed. In particular, infrared, radar, optical laser radar (ladar), imaging and non-imaging, and acoustic sensors are individually covered. Of special interest is the discussion on human visionics versus machine recognition, since this concept is of central importance to understanding autonomous versus man-in-the-loop sensing systems. The implications of "artificial intelligence", "data fusion", and "multi-mode" sensors are also briefly discussed. System constraints, which force tradeoffs in sensor design and in ultimate performance, are also covered. Time permitting, a projection of future trends in the role of sensors for smart munitions will be presented, followed by a "brain-storming" session to solicit student views.

About the Instructor:

Mr. Paul Kisatsky is a Senior Physical Scientist. He is a nationally recognized expert on sensors and seekers for smart munitions and weapons and has more than 30 years of hands-on experience developing sensors and seekers fielded in modern smart munitions and weapons.

Security Classification:

The security classification of this course is UNCLASSIFIED, but is designated export controlled and limited to U.S. citizens only.

Training at Your Location:

WSTIAC can conduct this course at your location to reduce your travel time and cost. Please call Mrs. Kelly Hopkins to discuss.

Fee:

The registration fee for this 3-day course is $950 for U.S. government personnel and $1150 for government contractors. Contractor teams of 3 or more, registered at the same time, are charged $950 per person.

Handout Material:

Each student will receive a comprehensive set of course notes covering the material presented.

For additional information, contact:
Mrs. Kelly Hopkins, Seminar Administrator,
at (256) 382-4747, or by e-mail
khopkins@alionscience.com

Notice: WSTIAC reserves the right to cancel and/or change the course schedule, agenda and/or instructor. In the event of a schedule change or cancellation, registered participants will be individually informed.

Calendar of Events

Upcoming Conferences and Courses

November 2006

5-8 November 2006
AOC 43rd Annual Convention
Washington, DC
For additional information:
https://www.myaoc.org

13-16 November 2006
6th Annual CMMI Technology Conference and User Group
Denver, CO USA
For additional information:
Email: bbommelje@ndia.org
Web site: http://www.ndia.org/Template.cfm?Section=7110

14-16 November 2006
AIAA Missile Sciences Conference
Monterey, CA
For additional information:
http://www.aiaa.org/content.cfm?pageid=230&lumeetingid=1184

27-30 November 2006
25th Army Science Conference (ASC)
Orlando, FL USA
For additional information:
Web site: http://www.asc2006.com

December 2006

4-8 December 2006
2006 Defense Spectrum Summit
Annapolis, MD
For additional information:
http://www.afcea.org/events/spectrum/info.asp

13-15 December 2006
2006 45th IEEE Conference on Decision and Control (CDC)
San Diego, CA
For additional information:
http://www.ieeecss.org/CAB/conferences/cdc2006/index.php

February 2007

4-6 February 2007
2007 Tactical Wheeled Vehicles Conference
Monterey, CA
For additional information:
http://eweb.ndia.org/eweb/DynamicPage.aspx?Site=ndia&Webcode=EventList

5-7 February 2007
2007 Munitions Executive Summit
Arlington, VA
For additional information:
http://eweb.ndia.org/eweb/DynamicPage.aspx?Site=ndia&Webcode=EventList

21-22 February 2007
Warfighter's Vision 2007: Winning the Global Fight
Alexandria, VA
For additional information:
http://www.afei.org/brochure/7a04/index

26-28 February 2007
18th Annual Special Operations/Low Intensity Conflict Symposium
Arlington, VA
For additional information:
http://eweb.ndia.org/eweb/DynamicPage.aspx?Site=ndia&Webcode=EventList

March 2007

19-23 March 2007
Annual U.S. Missile Defense Conference
Washington, DC USA
For additional information:
http://www.aiaa.org/content.cfm?pageid=230&lumeetingid=1475

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